

ELECTRON SPECTRO-MICROSCOPY FACILITY FOR FUNDAMENTAL STUDIES OF THE PHYSICS AND CHEMISTRY OF MATERIALS (ESM)



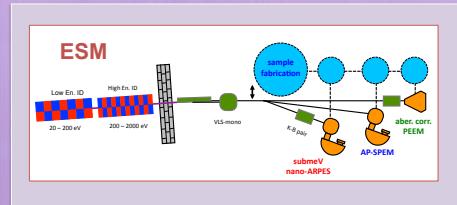
Group Leader: E. Vescovo **Proposal Team:** D. Arena¹, J. Chen², T. C. Chiang³, S. Hulbert¹, P.D. Johnson¹, A. Kaminski⁴, M. Kiskinova⁵, R. Osgood, Jr.⁶, R. Reininger¹⁰, J. Rodriguez¹, J. T. Sadowski¹, B. Sinkovic⁷, K. Smith⁸, D. Starr¹, R. Tromp⁹, T. Valla¹, E. Vescovo¹

¹Brookhaven National Lab, ²Univ. Of Delaware, ³Univ. Of Illinois, ⁴AMES Lab, ⁵ELETTRA, ⁶Columbia Univ., ⁷Univ. of Connecticut, ⁸Boston Univ., ⁹IBM, ¹⁰Argonne National Laboratory

NATIONAL SYNCHROTRON LIGHT SOURCE II NEXT project • funded by DOE

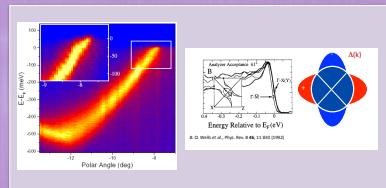
TECHNIQUES AND CAPABILITIES

- Source: 2 ID – EPU 105 (3 m, PM , 20-200 eV)
EPU 56 (3 m PM, 200-2000 eV)
- High-Resolution Angular Resolved Photoemission Scanning Microscopy (μ -ARPES): 20-1500 eV, 1 μ m, < 1 meV, <0.1°, 5-2000 K
- Ambient Pressure Scanning Photoelectron Microscopy (AP-SPEM): 200-1800 eV, < 300 nm, 10^{+3} Torr
- Low-Energy Electron Microscopy & X-ray Photoemission Electron Microscopy (LEEM/XPEEM): 20 – 1800 eV, < 10 nm, high-transmission aberration correction

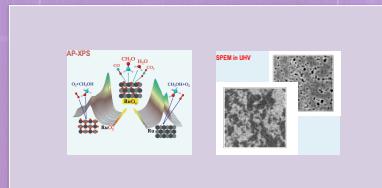


E-range 20 – 2000 eV
E-resol. < 1 meV to 70 eV (0.2 meV @ 20 eV)
< 10 meV to 1000 eV
< 100 meV to 2000 eV
Flux $>10^{12}$ ph/sec @ 10000 resolving power
Spot-size 1 μ m (K-B), ~ 50 nm (ZP)

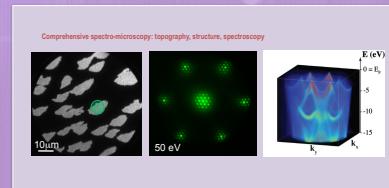
APPLICATIONS



μ -SP-ARPES:
Momentum-resolved electronic structure electronic bands of magnetic materials and non-magnetic materials with le of solids; spin-polarized large spin-orbit interaction; a 1 μ m spot from NSLS-II will allow for scanning spectro-microscopy.

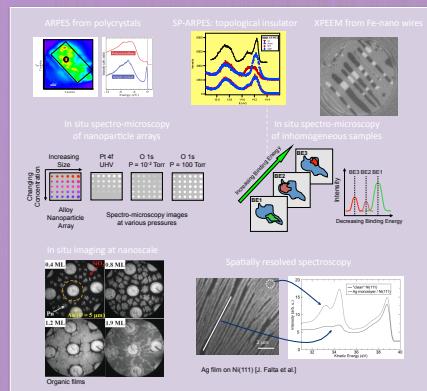


APSPEM:
Unites two experimental techniques (AP-XPS and SPEM) to provide < 300 nm spatially resolved, quantitative chemical analysis of surfaces at pressures up to atmospheric pressure. This is a direct result of the superb brightness of NSLS-II in the soft-x-ray region.



XPEEM:
Energy-filtered XPEEM with aberration-corrected, high transmission imaging spectrometer is an intrinsically non-destructive, fast-imaging technique allowing simultaneous surface-sensitive microscopy and spectroscopy.

SPECIFIC PROJECTS / ADDITIONAL INFORMATION



- ARPES from spatially inhomogeneous samples, as well as artificially formed hetero-structures (nano-dots, wires, field-effect transistors, graphene ribbons, etc.)
- ARPES from polycrystalline or micro-crystal materials
- SP-ARPES from inside a magnetic domain
- AP-SPEM: chemical mapping of inhomogeneous and nanofabricated samples with spatial resolution of 300 nm or less
- XPEEM: fast, full-field probe for spatially resolved topographic, structural and spectroscopic measurements